

Correlation between colonized bacteria of ET tube among suspected pneumonia patients of ICU

Bharati Ghosh¹, Kumarjyoti Ghosh^{2*}, Atanu Roy³, D. Pal⁴, A. Ghosh⁵, K. Mandal⁶

¹Assistant Professor, Department of Microbiology, I Care Medical College, Haldia, West Bengal, INDIA.

²Assistant Professor, ³Professor and Head, ⁴Professor, ⁵UG Student, Department of Microbiology, MGM Medical College, Kishanganj, Bihar, INDIA.

⁶Medical Technologist, MGM Medical College and LSK Hospital, Kishanganj, Bihar, INDIA.

Email: drkighosh@gmail.com

Abstract

Background: Secondary infection from invasive devices has become great problem in Intensive Care Unit (ICU) set ups throughout the world. Respiratory tract infection is an important cause of increasing mortality or morbidity with prolonged hospital stay. Against this background we studied the microbial colonization of endotracheal tube and tried to evaluate the outcome among the suspected pneumonic patients admitted in our Intensive Care Unit (ICU) Hospital. Lot of therapeutic problems occur which automatically increased mortality rate as well as cost of the treatment. This above study was designed to determine the frequency of microorganisms isolated from endotracheal tube in patients admitted in ICU of MGM Medical College and LSK Hospital, Kishanganj, Bihar from July 2009 to February 2013. **Materials and Methods:** Endotracheal tube aspirate samples taken from 541 suspected pneumonic patients and culture isolation of the organism were carried out. **Results:** The age distribution of most patients was between 65 to 85 years with the mean age of 70.7 ± 10.3 , all most 71% were male in comparison to 29% were female. Hospital stay time was 5-25 days with mean time 17.5 days. The median time of intubation was 6 days. The most common microorganism was Klebsiella spp. 36% Staph aureus 24%, E. coli 18%, Pseudomonas aureginosa 12%, Acinetobacter spp. 8%, Enterobacter spp. 1% and Staph. epidermidis 1%. **Conclusion:** There were predominance of Klebsiella and Staph aureus colonization in ET tube. However no earlier study was done in Bihar. We recommend further study among different hospitals of Bihar to determine the epidemiologic pattern of microorganism frequency. **Keywords:** ICU, Endotracheal tube, pneumonia.

*Address for Correspondence

Dr. Kumarjyoti Ghosh, Assistant Professor, Department of Microbiology, MGM Medical College, Kishanganj, Bihar, INDIA.

Email: drkighosh@gmail.com

Received Date: 08/06/2014 Accepted Date: 20/06/2014

Access this article online

Quick Response Code:	Website: www.statperson.com
	DOI: 24 June 2014

INTRODUCTION

Hospital acquired infection is an important health-care problem. 5-10% of hospitalized patients of developed

countries and about 25% of developing countries were affected by a nosocomial infection in 2005 as reported by WHO(1). Use of different types of catheters, endotracheal tubes, and different surgical apparatuses are the most important ways of nosocomial infection transmission. Respiratory tract infections, urinary tract infections, and superficial or deep ulcer infections are responsible for 80% of nosocomial infections (2). Of which, 1% of nosocomial infections are lethal and it costs about 10 billion dollars per year (3). In nosocomial pneumonia mortality rate is 50 % (4). In ICU, incidence of nosocomial infection is high. Irrational and overuse of newer generation antibiotic often results in multidrug resistance of microorganisms in hospital setup. Hospital personnel can be the microbial source. Use of invasive

diagnostic and therapeutic methods has saved many lives but on the other hand, it can cause some life threatening consequences due to severe, persistence and resistant infections (2-6). As per reported statistics, there are 2 million nosocomial infections per year in the United-States, which lead to an increase in cases of morbidity and mortality rate, as well as increased cost burden for the patient following long hospital stay. The purpose of this study was to determine the prevalence of bacterial species present in tracheal tubes in patients of suspected pneumonia admitted to MGM Medical College and LSK Hospital ICU during the 2009-2013.

MATERIAL AND METHODS

study which was set to determine the prevalence of bacterial species present in endotracheal tubes in MGM Medical College and LSK Hospital ICU, Kishanganj, Bihar during 2009-2013. Rejection criteria from ET tube of adult patients were primarily screened by direct microscopy, which include more than 10 Squamous epithelial cell/ lpf, with no bacteria were seen on gram stain. Samples were also rejected when there was poor documents regarding the sample, where the container was externally soiled or there was leakage.

Specimen

Specimens were obtained from tracheal tubes of ICU patients with endotracheal aspiration, when they had symptoms and signs of pneumonia (cough, purulent respiratory secretion, fever and new or progressive infiltration of lung in Chest X-ray) and were referred to the laboratory in the sterile container. The samples were cultured on chocolate agar, MacConkey agar, and blood agar as soon as they were received, and were put in incubator for 24 h in 37°C. After 24 h the colony character and gram staining were studied and the bacterial strains were determined according to biochemical tests. Out of 541 suspected pneumonia patients 271 cases were studied and rest 270 are excluded because of negative culture and poor documents. In data analysis, percentage and frequencies per year were reported. Pneumonia was defined as presence of fever, WBC more than 12K or less than 4K, infiltrate on CXR-PA, purulent sputum with positive lower airway culture.

METHODS

Aseptically collected aspirated material and ET tube tips were at first rolled over blood agar (BA) media and MacConkey media agar (MA). The ET tube tips put into peptone water, incubated for 2 hrs in 37°C and reinoculated in BA and MA. The plate were incubated at 37° C for 24 hrs. and the colony morphology was studied. Grams Stain was performed and motility study by hanging drop preparation was done. Different

biochemical examination together with catalase and coagulase test was carried out to identify the organism. Simple and cheap techniques were followed as below. After gram stain cocci were identified and processed as follow. Catalase positive cocci include micrococci and staphylococci. Now on the basis of mannitol fermentation Staph aureus were identified (positive). Mannitol non fermenters were tested with OF test. Staph spp were fermentative they were again put to Coagulase test (tube Coagulase) and Novobiocin sensitivity test to confirm Staph epidermidis. Gram negative bacilli those were lactose fermentative were tested for VP test. VP positive strain were Klebsiella and Enterobacter spp. By performing motility test they were separated. Enterobacter were motile but Klebsiella were non motile. VP negative bacteria were tested for growth in Simmon's citrate media to rule out Citrobacter spp and then tested with indole. Indole positive strain was E. coli and confirmed by positive motility test. For non fermenters like Pseudomonas aeruginosa and Acinetobacter spp Gram negative rods were put into OF test in two tubes of which one tube with paraffin over lay. OF negative and Oxidase negative were either Acinetobacter or Stenotrophomonas. However non motile strain were Acinetobacter. Non fermenters those were oxidative in OF, Oxidase positive with fluorescent pigment production and grows at 42°C were considered as P. aeruginosa.

RESULTS

In this study 271 patients who had tracheal tube aspirate positive culture were studied. The age average was found to be 70.7±10.3 (between 65 to 85 yr). A total of 192 cases were male (71%) and 79 cases were female (29%). The hospital stay duration average was 17.5 days (between 5 to 25 days). Day of intubation was also evaluated; it was shown that duration of being intubated had a median of 6 days. We cared also for any underlying disease whether present or not. Underlying diseases taken into consideration were DM (diabetes mellitus), HTN (hypertension), hyperlipidemia, cardiovascular diseases, pulmonary diseases, and renal diseases. 65% of patients had at least one underlying disease. In this study bacterial species present in endotracheal tubes were isolated and the results showed that the most common bacteria present in the tracheal tube were *Klebsiella spp* (36%), *S. aureus* (24%), *E. coli* (18%), *P. aeruginosa* (12%), *Acinetobacter* (8%), *Enterobacter* (1%), *S. epidermidis* (1%). The results suggested that, the most common microorganism was *Klebsiella spp*. (36%) and the least common were *Enterobacter spp*. (1%) and *S. epidermidis* (1%). Frequency distribution of bacterial species present in tracheal tubes of suspected pneumonic patients admitted in ICU has been given in (Table 1).

Table 1: Age and sex distribution.

No of patients	Age 20-40 years		Age 41-60 years		Age 61 and above	
	Male	Female	Male	Female	Male	Female
271	20	7	30	12	142	60

Table 2: Risk factors involved in the patients.

Underlying diseases	Age 20-40 years		Age 41-60 years		Age 61 and above	
	Male	Female	Male	Female	Male	Female
Diabetes mellitus	08	03	12	05	60	27
Hypertension	01	-	03	01	25	10
CVA	-	-	01	-	04	01
Renal disease	02	-	02	01	06	02
Pulmonary disease	09	04	12	05	47	20

Table 3: Frequency distribution of bacterial species present in tracheal tubes of patients admitted in ICU of MGM Medical College and LSK Hospital ICU during the 2009-2013.

Bacterial species	Number of cases (%)
<i>Klebsiella</i> spp	n= 98 (36%)
<i>S. aureus</i>	n= 65 (24%)
<i>E. coli</i>	n= 48 (18%)
<i>P. aeruginosa</i>	n= 32 (12%)
<i>Acinetobacter</i> spp.	n= 22 (8%)
<i>Enterobacter</i> spp.	n= 3 (1%)
<i>S. epidermidis</i>	n= 3 (1%)

DISCUSSION

Out of 541 patients hospitalised with the signs and symptoms of pneumonia only 271 cases shows culture positivity when the microorganism were identified by routine laboratory procedures our study showed the isolation of *Klebsiella* spp as the most frequent colonizer followed by *Staph aureus*, *E. coli*, *P. aeruginosa* etc. the study report by M. Amini *et al.* in 2008-2009 showed the most commonly observed bacteria to be *Staph aureus*. Our study significantly differs from the above mentioned study. There was a report by Willson *et al* which showed stage 4 biofilm were associated with ET tube related pneumonia. There was no relationship to duration of intubation, patient's age or hospital stay. **Therefore there may be a possibility that the *Klebsiella* spp present in the hospital environment may have acquired the ability to form biofilms in the ET tube.** The continuation of the study should be directed towards exploring the possibility. The culture positive pneumonic patients were treated with specific antibiotic as per AST report and satisfactory results i.e. early recovery was achieved.

CONCLUSION

From the above discussion it is quite clear that early identification of colonized bacteria of ET tubes and specific treatment is often rewarding. From the above study it is also clear that *Klebsiella* Sp. is increasingly found in the ET tube culture. Their involvement in the biofilm formation is a subject of further research. So we recommend more similar study in other hospitals to determine the epidemiologic pattern of microorganism frequency. The microbiology of endotracheal tube culture has definite role in proper diagnosis not only in adult but also in new born ICU. Subglottis stenosis, bronchopulmonary dysplasia and ventilator associated pneumonia are diagnosed following ET tube infection in new born. So, a detection system of a biofilms in ET tube by using biomarkers could aid but kit is not easily available. So an early diagnosis could contribute unnecessary prescription of antibiotics to all^{21, 22}.

REFERENCES

- Iranian guideline of nosocomial infection control, Islamic republic of Iran, part one, 1385. Page 1-2
- Mandal B, Wilkins E, Dunbar E. Infectious Disease. 58th ed. Oxford: Blackwell; 1996.
- Carpenter G, Grigg S. Cecil Essential of Medicine. 5th Ed. New York: A Harcourt Health sciences company; 2000.
- Braunwald A. Harrison, Principles of Internal Medicine. 15th Ed. New York: McGeaw-Hill; 2001.
- Gomes CC, Vormittag E, Santos CR, Levin AS. Nosocomial infection with cephalosporin-resistant *Klebsiella pneumoniae* is not associated with increased mortality. *Infect Control Hosp Epidemiol* 2006; 27(9):907-12.
- Molana Z, Arshi M, Sedighian F. Urinary and Respiratory Nosocomial Infection in ICU Patients, Proceeding of First Congress of Microbiologic Laboratory Rol in Control and Prevention of Nosocomial Infection, 2002. *Indian J Gastroenterol* 2008; 27(6):239-41.
- Soltani H, Veysi Raygani A, Zeraatkari K, Soleimani B. Comparison Evaluation of Anti Septic Effect of Saidex, Savlen and H2o2 on Ventilatory Equipments Infection. *Journal of Research in Medical Sciences* 2004; 5(4):320-2.
- Askarian M, Hosseini R, Kheirandish P. Evaluation of Incidence and Etiology of Nosocomial Infection in Barn Patients Admitted to Ghotbedin Hospital of Shiraz. *Journal of Kerman medical science university* 2003; 10(2):65-70.
- Ghanaat J, Sadeghian A, Ghazvini K. Evaluation of Vol.4 No.3, summer 2009 Bacterial Infection in Ghaem Hospital of Mashad in 10 Past Year. *Iran J ENT* 2004; 28-35.
- Yosefi Mashoof R, Heydari Z. Evaluation of ICU Bacterial Infection in Hamedan's Hospital. *Journal of Hamedan medical science university* 2003; 3(2):93-9.

11. Sharif A, Emami A, Mazochi T, Mosavi G, Verdi J, Yarandi M. IV Catheter Infections and Etiologic Factor in ICU Patients. *Scand J Immunol* 2002 ;(22):53-8.
12. Kohpayeh H. Frequency of Bacterial Nasocomial Infection in ICU Patients at Khatamol Anbia Hosspital Zahedan University of Medical Sciences (Thesis); 2002.
13. Zamanzad B, Kheradvar D. Bacterial Sensitivity to Antiseptic Material in Nasocomial Wards in Kashani Hospital. *Journal of Shahre kord medical sciences university* 2001; 3(4):25-30.
14. Meric M, Willke A, Caglayan C, Toker K. Intensive care unit-acquired infections: incidence, risk factors and associated mortality in a Turkish university hospital. *Jpn J Infect Dis* 2005; 58(5):297-302.
15. Ndugulile F, Jureen R, Harthug S, Urassa W, Langeland N. Extended spectrum beta-lactamases among Gram-negative bacteria of nosocomial origin from an intensive care unit of a tertiary health facility in Tanzania. *BMC Infect Dis* 2005; 5:86.86.
16. Nseir S, Di PC, Soubrier S, Cavestri B, Jozefowicz E, Saulnier F, *et al.* Impact of ventilator-associated pneumonia on outcome in patients with COPD. *Chest* 2005; 128(3):1650-6.
17. Gladstone P, Rajendran P, Brahmadathan KN. Incidence of carbapenem resistant nonfermenting gram negative bacilli from patients with respiratory infections in the intensive care units. *Indian J Med Microbiol* 2005; 23(3):189-91.
18. Adair CG, Gorman SP, Byers LM, Jones DS, Feron B, Crowe M, *et al.* Eradication of endotracheal tube biofilm by nebulised gentamicin. *Intensive Care Med* 2002; 28(4):426-31.
19. Tullu MS, Deshmukh CT, Baveja SM. Bacterial profile and antimicrobial susceptibility pattern in catheter related nosocomial infections. *J Postgrad Med* 1998; 44(1):7-13.
20. Friedland DR, Rothschild MA, Delgado M, Isenberg H, Holzman I. Bacterial colonization of endotracheal tubes in intubated neonates. *Arch Otolaryngol Head Neck Surg* 2001; 127(5):525-8.
21. willson A, gray D, Karakiojis J, Thomas J, advanced ET tube biofilms stage, not duration of intubation, is related to Pneumonia, trauma acute care surgery, 2012, apr; 72(4), p- 916-923.
22. Gibbes K, Hotzman R, ET tube; friend or foe? Bacteria, the ET tube and the impact of colonization and infection – seminar perinatology, 2012, dec; 36(6), P - 454-461.

Source of Support: None Declared
Conflict of Interest: None Declared